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“पुराने को छोड़ नये के तरफ”

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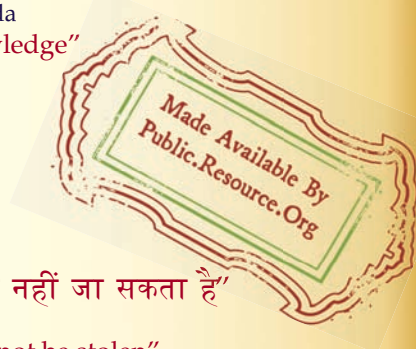
IS 1865 (1991): Iron castings with spheroidal or nodular graphite [MTD 6: Pig iron and Cast Iron]



“ज्ञान से एक नये भारत का निर्माण”

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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

गोलाभ और नोडुलीय ग्रेफाइट वाली लोह ढलाइयाँ –
विशिष्ट

(तीसरा पुनरीक्षण)

Indian Standard

IRON CASTINGS WITH SPHEROIDAL OR
NODULAR GRAPHITE — SPECIFICATION

(*Third Revision*)

Third Reprint MARCH 1998

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pig Iron and Cast Iron Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1961 and subsequently revised in 1968 and 1974. In this third revision, the following major changes have been incorporated:

- a) The classification of spheroidal or nodular graphite cast irons has been made based on the mechanical properties of the material measured on the test pieces prepared from separately-cast test samples, and on the test pieces prepared from cast-on test samples;
- b) Classification made on the basis of hardness has also been included if hardness is recognised by the purchaser and the manufacturer as being essential for the application such as in automobile industry;
- c) The provisions of the standard have generally been aligned with the ISO/1083 : 1987 'Spheroidal graphite cast iron — Classification' issued by International Organization for Standardization.
- d) For the classification as a function of mechanical properties measured on separately-cast test samples, one new Grade SG 900/2 has been included; and
- e) The two existing grades namely SG 400/12 and SG 370/17 have been replaced by SG 450/10 and SG 400/15 and SG 400/18 & SG 350/22 respectively. The grades SG 400/18 and 350/22 are meant for applications involving high impact loads and/or subzero service temperatures. Impact values for these two grades have been stipulated at ambient as well as at subzero temperatures.

Spheroidal or nodular graphite cast iron or ductile iron is a casting alloy of iron and carbon, carbon being present in the spheroidal form.

The properties of spheroidal graphite cast iron depend, particularly, on a form (shape and size) of the graphite and the structure of the matrix which can be changed or altered by suitable heat treatment. Graphite flakes in cast iron act as discontinuities in the matrix and thus lower its mechanical properties. The sharp corners of the flakes also act as stress raisers. The weakening effect of the graphite can be overcome by changing its form from a flake to a spheroidal form.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

IRON CASTINGS WITH SPHEROIDAL OR NODULAR GRAPHITE — SPECIFICATION

(Third Revision)

1 SCOPE

1.1 This standard covers grades and the requirements of iron casting with spheroidal or nodular graphite classified on the basis of:

- a) mechanical properties measured on test pieces prepared from separately-cast test samples, and
- b) mechanical properties measured on test pieces prepared from cast-on test samples.

1.2 Grades and requirements of spheroidal cast iron, classified on the basis of hardness are given in Annex A. These are subject to the mutual agreement between the purchaser and the manufacturer.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
1387 : 1967	General requirements for the supply of metallurgical materials (<i>first revision</i>)
1500 : 1983	Method for Brinell hardness test for metallic materials (<i>second revision</i>)
1608 : 1972	Method for tensile testing of steel products (<i>first revision</i>)
1757 : 1988	Method for charpy impact test (V notch) for metallic materials (<i>second revision</i>)
7754 : 1975	Method for designation of the microstructure of graphite in cast iron
8350 : 1977	Deviations for untoleranced dimensions of spheroidal or nodular graphite iron castings

3 GRADES

3.1 Grades Based on Mechanical Properties Measured on Separately-Cast Test Samples

The following nine grades of spheroidal graphite cast iron for this category are:

SG 900/2, SG 800/2, SG 700/2, SG 600/3, SG 500/7, SG 450/10, SG 400/15, SG 400/18 and SG 350/22.

3.1.1 These grades apply to castings from sand moulds of comparable thermal diffusivity. Subject to agreement these may also apply to casting obtained by other methods such as from static moulds or centrifugal castings. They, however, do not apply to castings obtained by continuous castings.

3.2 Grades Based on Mechanical Properties Measured on Cast-On Samples

The following six grades of spheroidal cast iron for this category are:

SG 700/2A, SG 600/3A, SG 500/7A, SG 400/15A, SG 400/18A and SG 350/22A.

3.2.1 These grades normally apply to castings of thickness between 30 mm and 200 mm and with a unit mass greater than 2 000 kg.

NOTE — The letter 'A' after the designation of the grade indicates that the properties are obtained on cast-on test samples to distinguish them from those obtained on separately-cast test samples given in 3.1

4 SUPPLY OF MATERIALS

4.1 General requirements relating to the supply of spheroidal cast iron shall conform to IS 1387 : 1967.

5 MANUFACTURE

5.1 The method of manufacture, including the chemical composition and the heat treatment, shall be left to the discretion of the manufacturer who shall ensure that the property requirements specified in this standard are complied with the grade specified in the order. Record of heat-treatment, if any, of each batch shall be maintained by the manufacturer.

5.2 For the castings to be used in special applications, however, the type of sample, chemical composition, inspection, and heat treatment may be as per the agreement between the purchaser and the manufacturer.

6 WORKMANSHIP AND FINISH

6.1 The castings shall be accurately moulded (and cored) in accordance with the pattern equipment and/or working drawings supplied by the purchaser with addition of such letters, figures or marks as specified.

6.2 The drawings shall specify the tolerances on all important dimensions of unmachined castings. For untoleranced dimensions the tolerances as per IS 8350 : 1977 shall be applicable or in accordance with the mutual agreement between the purchaser and the supplier.

7 HEAT TREATMENT

7.1 Unless otherwise specified and mutually agreed between the purchaser and the manufacturer, the castings may be supplied without heat-treatment if the specified mechanical properties are attained without heat-treatment.

7.2 When heat-treated, the heat-treatment cycle shall be decided by the manufacturer, provided the specified mechanical properties are met with after the heat-treatment.

8 FREEDOM FROM DEFECTS

8.1 The castings shall be sound, clean and free from blow-holes, slag inclusions, distortion, hard spots, sand-fusion and all surface or other defects that are likely to affect the utility of the castings. They shall be well-dressed and fettled and shall be readily machinable by methods normal for the grade. Castings shall not be repaired, welded or plugged except by agreement between the purchaser and the manufacturer.

8.2 Also any inherent defects revealed during subsequent machining, notwithstanding any previous certificate of satisfactory testing, shall render the castings liable for rejection.

9 MICRO STRUCTURE

9.1 Where a metallographic test is required to check the nodularity of graphite, it shall be verified that the structure contains a minimum of 80 percent graphite in the form of V or VI as specified in IS 7754 : 1975.

9.2 Once the specified mechanical properties and the nodularity of graphite have been met with and absence of massive carbides has been confirmed, normally there is no need to additionally specify relative proportion of micro-constituents (namely, ferrite, pearlite or tempered structure) in the matrix of the microstructure. However, in case of specific applications, the relative proportion of these micro-constituents may be specified subject to the agreement between the purchaser and the manufacturer. The number of observations and sampling conditions shall be as per the mutual agreement between the purchaser and the manufacturer.

10 TEST SAMPLES AND TEST PIECES

10.1 Separately-Cast Test Samples

10.1.1 Test samples shall be cast separately in sand moulds. They shall be poured from the same ladle

of metal as that used to produce the castings they represent. They shall be cast towards the end of the casting operation.

10.1.2 The shape of test sample shall be selected from those shown in Fig. 1, 2 or 3. The test-pieces shall be machined either from the hatched section shown in Fig. 1 and 2 or the round bars in Fig. 3.

10.1.3 Unless otherwise stated, test samples Type II, IIa or IIb, of 25 mm effective thickness shall be used. However, subject to the agreement between the purchaser and the manufacturer, test samples of other sizes shown in Fig. 1 and 2 may be selected so that the cooling rate in the hatched portion of the test samples is as close as possible to that of the castings they represent.

10.1.4 Test samples shall be stripped from the mould at a temperature not exceeding 500°C.

10.1.5 When castings are supplied in heat-treated condition, all test samples shall be heat-treated similar to, simultaneously with and adjacent to, the casting or castings they represent.

10.2 Cast-on Test Samples

10.2.1 The test samples from which the test pieces for tensile and for impact test are taken shall be cast-on to the casting. Cast-on test samples may be selected in preference to the separately cast test samples when the unit mass of the casting exceeds 2 000 kg and when the reference thickness may vary between 30 mm and 200 mm.

10.2.2 The positioning of the cast-on samples shall be agreed to by the manufacturer and the purchaser, taking into account the shape of the casting and its gating and feeding system, so as to avoid any unfavourable effect on the properties of the adjacent metal.

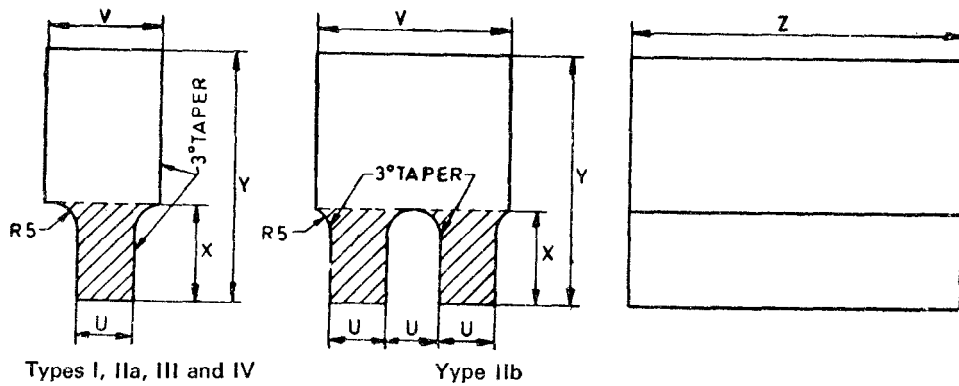
10.2.3 Unless specially agreed, the test samples shall have the shape and dimensions indicated in Fig. 4.

10.2.4 As far as practicable, the cast-on samples shall not be separated from the casting until after the heat-treatment. Should it become necessary, however, to separate them before heat-treatment, they shall be heat-treated similar to, simultaneously with and adjacent to the casting they represent.

11 SAMPLING FOR MECHANICAL TESTS

11.1 Batch

11.1.1 A batch shall constitute all the castings poured from the same ladle of treated metal, and, where applicable, which have been submitted to the same heat-treatment. The maximum mass of one batch shall not exceed 2 000 kg of fettled castings, but a single casting may constitute a batch if its mass is equal to or greater than 2 000 kg.



Types I, IIa, III and IV

Type IIb

All dimensions in millimeters.

Dimension	For Type				
	I	IIa	IIb	III	IV
u	12.5	25	25	58	75
v	40	55	90	90	125
x	30	40	40	60	65
y ¹⁾	80	100	100	150	165
z	A function of the test piece length				

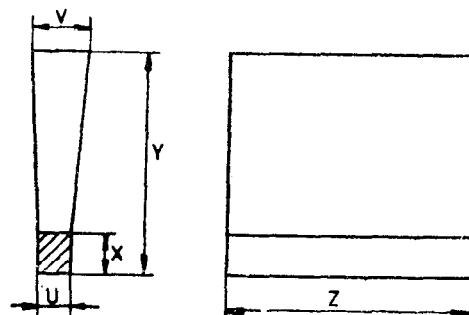
The thickness of the sand mould surrounding the test sample shall be:

- 40 mm minimum for Types I, IIa and IIb, and;
- 80 mm minimum for Types III and IV.

NOTE — For the manufacture of thin castings or castings in static moulds, the tensile properties may, by agreement between the purchaser and the manufacturer, be determined on test pieces taken from test samples of thickness less than 12.5 mm.

¹ For information only.

FIG. 1 'U'-SHAPED CAST TEST SAMPLES



All dimensions in millimetres.

Dimension	For Type			
	I	II	III	IV
u	12.5	25	50	75
v	20	55	100	125
x	25	40	50	65
y ¹⁾	135	140	150	175
z	A function of the test piece length			

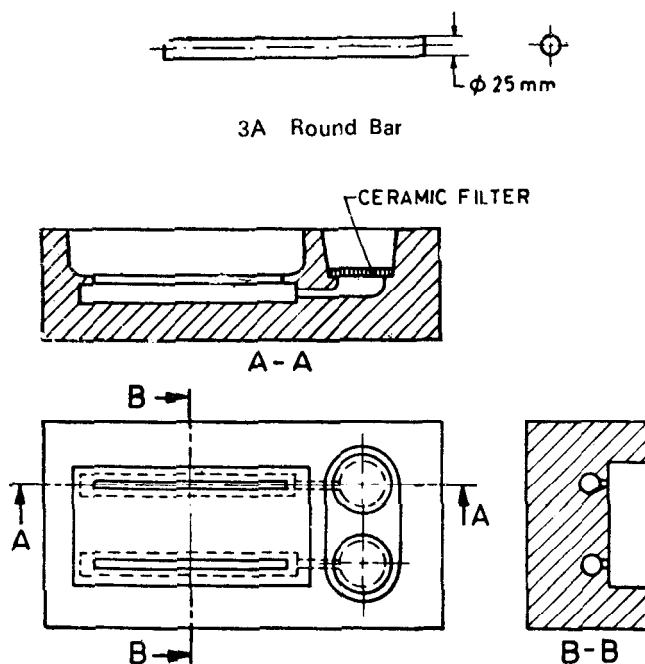
The thickness of the sand mould surrounding the test sample shall be:

- 40 mm minimum for Types I and II, and
- 80 mm minimum for Types III and IV.

NOTE — For the manufacture of thin castings or castings in static moulds, the tensile properties may, by agreement between the purchaser and the manufacturer, be determined on test pieces taken from test samples of thickness less than 12.5 mm.

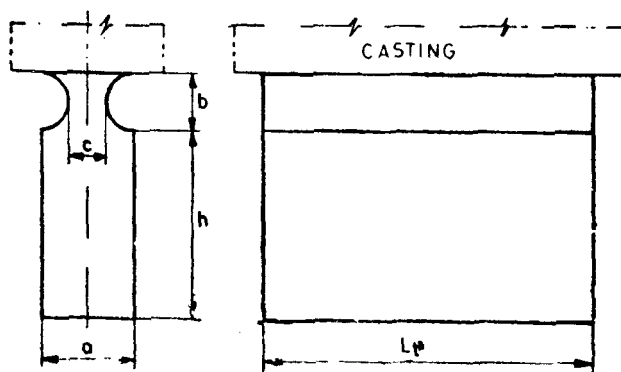
¹ For information only.

FIG. 2 'Y'-SHAPED CAST TEST SAMPLES



3B Schematic Drawing of a Mould

FIG. 3 ROUND BAR SHAPED SEPARATELY CAST TEST SAMPLE



All dimensions in millimetres.

Typical casting Thickness in mm	a	b min	c min	h	L ₁ *
30 to 60	40	30	20	40 to 60	180
61 to 200	70	52.5	35	70 to 105	180

*The recommended total length, L_1 is 180 mm. In very special cases it may be reduced, but not less than 155 mm.

NOTE — If smaller dimensions are agreed upon, the following relationship shall be adhered to:

$$b = 0.75a \quad \text{and} \quad c = a/2.$$

FIG. 4 CAST-ON SAMPLE BLOCK

11.1.2 In case of continuous production of larger tonnages, the maximum mass of a batch may be increased beyond single treatment, but shall not exceed the tonnage produced by the melting furnace concerned during a 2-hour period. This will, however, be subject to mutual agreement between the purchaser and the manufacturer, and provided the manufacturer has a well defined practice of checking nodularity of sample poured from each treatment.

11.2 Number of Tests per Batch

11.2.1 One tensile test shall be conducted on a test representing each batch of castings. The batch is defined in 11.1.1 and 11.1.2, as the case may be.

11.2.2 For casting weighing two tonne and above, if the test sample is being cast as an integral part of the casting by mutual agreement between the purchaser and the manufacturer, each individual casting will be treated as a separate batch.

11.3 The impact test applies only to grades SG 400/18, SG 400/18L, SG 350/22 and SG 350/22L, both for separately-cast and cast-on test samples. For this test one set of three test pieces shall be tested at the specified temperature for each batch.

11.4 All test samples and castings shall be marked for correct identification.

12 MECHANICAL PROPERTIES

12.1 Tensile Strength, Proof Stress, Elongation and Additional Information

12.1.1 Minimum tensile strength, minimum 0.2 per-

cent proof stress and minimum elongation for the grades specified in 3.1 (separately-cast test samples) shall conform to the values given in Table 1. Brinell hardness values and predominant constituents of the matrix have also been given in the table for information.

12.1.2 Minimum tensile strength, minimum 0.2 percent proof stress and minimum elongation for the grades specified in 3.2 (cast-on test sample) shall conform to the values given in Table 2. Brinell hardness values and predominant constituents of the matrix have also been given in the table for information.

12.2 Impact Test

12.2.1 Minimum impact values measured on test pieces from separately-cast test samples for the grades SG 400/18, SG 400/18L, SG 350/22 and SG 350/22L shall be as given in Table 3.

12.2.2 Minimum impact values measured on test samples from cast-on test samples for the grades SG 400/18A, SG 400/18AL, SG 350/22A and SG 350/22AL shall be as given in Table 4.

NOTE — The letter L above indicates that the corresponding grade shall have the specified impact strength at low temperature as given in Tables 3 and 4.

12.3 In case of tests carried out on test bars cut from the finished castings, the mechanical properties shall be as agreed to between the purchaser and the manufacturer.

Table 1 Mechanical Properties Measured on Test Pieces from Separately Cast Test Samples

Grade	Minimum Tensile Strength, MPa ¹⁾	Minimum 0.2 Percent Proof Stress, MPa	Minimum Elongation, Percent ²⁾	For Information Only	
				Brinell Hardness, HBS	Predominant Constituent of Matrix
SG 900/2	900	600	2	280 to 360	Bainite or tempered martensite
SG 800/2	800	480	2	245 to 335	Pearlite or tempered structure
SG 700/2	700	420	2	225 to 305	Perlite
SG 600/3	600	370	3	190 to 270	Pearlite + ferrite
SG 500/7	500	320	7	160 to 240	Ferrite + pearlite
SG 450/10	450	310	10	160 to 210	Ferrite
SG 400/15	400	250	15	130 to 180	Ferrite
SG 400/18	400	250	18	130 to 180	Ferrite
SG 350/22	350	220	22	≤ 150	Ferrite

¹⁾ 1 MPa = 1 N/mm² = 10.2 kgf/cm².

²⁾ Elongation is measured on an initial gauge length $L = 5d$, where d is the diameter of the gauge length of the test piece (see Fig. 5).

Table 2 Mechanical Properties Measured on Test Pieces from Cast on Test Samples
(Clause 12.1.2)

Grade	Typical Casting Thick- ness, mm	Minimum Tensile Strength, MPa ¹⁾	Minimum 0.2 percent Proof Stress, MPa ¹⁾	Minimum Elong- ation, Percent ²⁾	For Information Only	
					Brinell Hardness, HBS	Predominant Constituent of Structure
SG 700/2A	30 to 60	700	400	2	220 to 320	Pearlite
	61 to 200	650	380	1		
SG 600/3A	30 to 60	600	360	2	180 to 270	Pearlite + Ferrite
	61 to 200	550	340	1		
SG 500/7A	30 to 60	450	300	7	170 to 240	Ferrite + Pearlite
	61 to 200	420	290	5		
SG 400/15A	30 to 60	390	250	15	130 to 180	Ferrite
	61 to 200	370	240	12		
SG 400/18A	30 to 60	390	250	15	130 to 180	Ferrite
	61 to 200	370	240	12		
SG 350/22A	30 to 60	330	220	18	≤ 150	Ferrite
	61 to 220	320	210	15		

¹⁾ 1 MPa = 1 N/mm² = 10.2 kgf/cm².

²⁾ Elongation is measured on an initial gauge length $L = 5d$, where d is the diameter of the gauge length of the test piece (see Fig. 5).

Table 3 Minimum Impact Values Measured on Test Pieces from Separately Cast Test Samples
(Clauses 12.2.1, 12.2.2 and 13.3.1)

Grade	Minimum Impact Values in Joules on V-Notch Test Pieces at Ambient Temperature of					
	(23 ± 5)°C		(- 20 ± 2)°C		(- 40 ± 2)°C	
	Mean Value from 3 Tests	Individual Value	Mean Value from 3 Tests	Individual Value	Mean Value from 3 Tests	Individual Value
SG 400/18	14	11				
SG 400/18L			12	9		
SG 350/22	17	14				
SG 350/22L					12	9

13 TESTS

13.1 Tensile Test

The tensile test shall be carried out in accordance with IS 1608 : 1972 unless otherwise agreed to between the purchaser and the manufacturer. The test piece shall have a gauge diameter of 14 mm and a gauge length of 70 mm (see Fig. 5). In case of test-sample of 12 mm size (i. e. Type I given in Fig. 1 and 2) the test piece shall have a gauge diameter of 8 mm and a gauge length of 40 mm.

13.1.1 During each tensile test the following properties shall be determined and reported:

- Ultimate tensile strength,
- 0.2 percent proof stress (only if specified by the purchaser at the time of ordering),
- elongation, and
- any additional information mutually agreed upon by the purchaser and the manufacturer.

In absence of facility to accurately measure 0.2 percent proof stress to determine compliance with proof stress requirements, the material tested shall be considered to have passed the test if it does not undergo an elongation exceeding the specified percentage value when subjected to the specified minimum stress for a period of 15 seconds and after removal of that load stress.

13.2 Hardness Test

When specified by the purchaser, the Brinell hardness test shall be done in accordance with IS 1500 : 1983.

13.2.1 The test shall be carried out on the test samples at one or several points on the castings in accordance with the agreement between the manufacturer and the purchaser. If the measuring points are not the subject to an agreement, this shall be selected by the manufacturer.

NOTE — In case the grades are specified on the basis of the hardness, a reference may be made to Annex A for the requirements.

13.3 Impact Test

The impact test shall be carried out on a V-notch charpy test piece in accordance with IS 1757 : 1988. The dimensions of the V-notch test piece shall be as given in Fig. 6.

13.3.1 Unless specified the impact test shall be conducted on the test pieces at the temperature specified in Table 3 or Table 4.

14 VALIDITY OF TESTS

14.1 A test may be disregarded if poor results are obtained and are not due to the quality of the iron itself, but due to any of the following reasons:

- Faulty mounting of the test piece or defective operation of test machine;
- Defective casting or machining of the test piece;
- Fracture of tensile test piece beyond middle 1/3rd of the gauge length; and
- Casting defects in the test-piece, evident after fracture.

Table 4 Minimum Impact Values Measured in Test Pieces from Cast-on Test Samples

(Clauses 12.2.2 and 13.3.1)

Grade	Typical Thickness, mm	Minimum Impact Values in Joules on V-Notch Test Pieces at Ambient Temperature of					
		(23 ± 5)°C		(- 20 ± 2)°C		(- 40 ± 2)°C	
		Mean Value from 3 Tests	Individual Value	Mean Value from 3 Tests	Individual Value	Mean Value from 3 Tests	Individual Value
SG 400/18A	30 to 60	14	11				
	61 to 200	12	9				
SG 400/18AL	30 to 60			12	9		
	61 to 200			10	7		
SG 350/22A	30 to 60	17	14				
	61 to 200	15	12				
SG 350/22AL	30 to 60					12	9
	61 to 200					10	7

14.1.1 In the above cases, a new test piece may be taken from the same test sample, or from the sample representing the same batch, and the results obtained substituted for those of the defective test piece.

15 RETEST

15.1 Should any of the tests fail to meet the specified property requirements, two re-tests per failed test may be carried out from the remaining test samples representing the same batch.

15.1.1 The batch is regarded as conforming to the specified requirements if the results of both re-tests conform to the values specified in the standard.

15.2 In case of castings supplied in the as-cast condition, the manufacturer, by agreement with the purchaser, has the right to heat-treat the castings together with the representative test samples and resubmit them for acceptance.

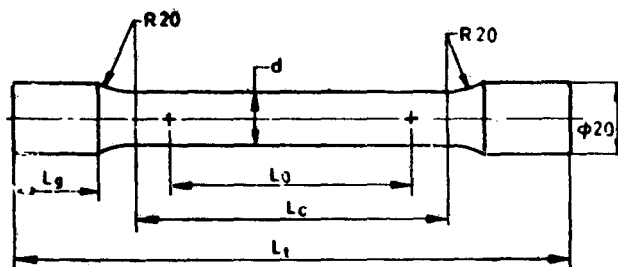
15.3 Should the samples of casting supplied in the heat-treated condition fail to pass the test, the manufacturer shall have the right to reheat-treat, not more than two times, the castings together with the representative test-bars and resubmit them for inspection and testing.

16 ADDITIONAL TEST

16.1 If the purchaser desires any special tests like NDT or any other, he shall state these when placing the inquiry and order for the castings. Subject to the agreement between the purchaser and the manufacturer, any one or all of these additional tests will be a part of material specifications.

17 MARKING

17.1 Unless desired otherwise by the purchaser each casting wherever practicable shall be legibly marked with identification marks by which it can be traced to the melt from which it was made.



L_0 is the original gauge length; i. e. $L_0 = 5 d$

d is the diameter of the parallel length of the test piece.

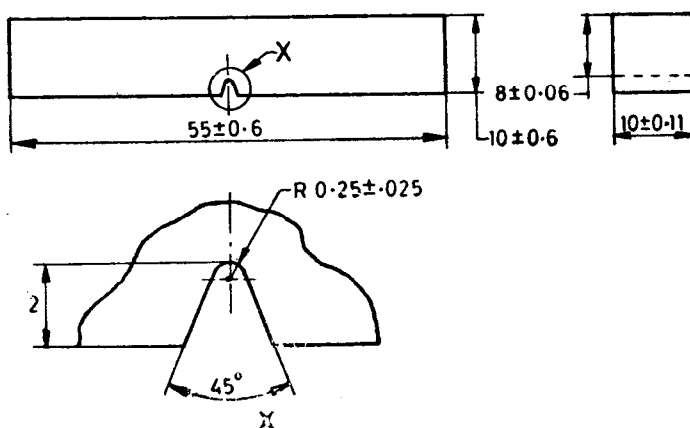
L_0 is the parallel length; $L_c > L_0$ by agreement between the manufacturer and the purchaser (in principle, $L_c - L_0 > d$)

L_1 is the total length of the test piece, which depends on L_0 and L_g .

NOTE — The method of gripping the ends of the test pieces, together with their lengths, may be agreed between the manufacturer and the purchaser, if the manufacturer so desires.

All dimensions in millimetres.

FIG. 5 TENSILE TEST PIECE



All dimensions in millimetres.

FIG. 6 IMPACT TEST PIECE

ANNEX A

(*Clauses 1.2 and 13.2*)

CLASSIFICATION AS A FUNCTION OF HARDNESS

A-1 GENERAL

In special cases, the spheroidal graphite iron castings if ordered on the basis of the hardness, shall conform to the requirements of this Annex.

A-2 GRADE AND REQUIREMENTS

A-2.1 The Brinell hardness values and predominant constituent of matrix for the zinc grades shall be as specified in Table 5. Tensile strength, 0.2 percent proof stress and elongation for the various grades have also been given in the table for information.

A-3 TEST SAMPLE

Brinell hardness shall be measured on the castings at points as mutually agreed to by the purchaser and the manufacturer. In the absence of any such agreement, location of hardness measurement shall be selected by the manufacturer.

A-4 TEST METHODS

A-4.1 The hardness test shall be carried out in accordance with IS 1500 : 1983.

A-4.2 If it is found not feasible to carry out the hardness test on the casting, then by agreement between the manufacturer and the purchaser, it may be conducted on a test piece cast-on to the castings (Brinell knob) themselves (*see* Fig. 7).

A-4.3 The position of the 'Brinell knob' shall be as agreed between the manufacturer and the purchaser taking into account the shape of the casting and the system of pouring, in order to avoid any unfavourable effect on the properties of the adjacent metal.

A-4.4 When castings are pre-heat-treated, these 'knobs' shall not be separated from the casting until after the heat treatment.

A-4.5 The hardness test shall be carried out on the cut surface closest to the casting.

Table 5 Classification of Grades on the Basis of Hardness

(Clause A-2.1)

Grade	Typical Brinell Hardness Ranges	Predominant Constituent of Matrix	For Information Only		
			Tensile Strength, Mpa	0.2 Percent Proof Stress, Mpa	Elongation, Percent
H 330	280 to 360	Bainite or tempered martensite	900	600	2
H 300	245 to 335	Pearlite or tempered structure	800	480	2
H 265	225 to 305	Pearlite	700	420	2
H 230	190 to 270	Pearlite + ferrite	600	370	3
H 200	170 to 230	Ferrite + Pearlite	500	320	7
H 185	160 to 210	Ferrite	450	310	10
H 155	130 to 180	Ferrite	400	250	15
H 150	130 to 180	Ferrite	400	250	18
H 130	≤ to 150	Ferrite	350	220	22

A-5 MICROSTRUCTURE

A-5.1 The number of tests and sample conditions for the metallographic test shall be as per the mutual agreement between the purchaser and the manufacturer.

Non-destructive methods exist for testing the nodularity of the graphite and the matrix structure which may be used, if necessary to limit the number of micrographs to be made.

A-5.2 It shall be verified in the metallographic test that the cast iron contains a minimum of 80 percent graphite or form V or VI in accordance with IS 7754 : 1975.

A-5.3 In case of specific application the relative proportion of the micro constituents may be

specified as mutually agreed between the purchaser and the manufacturer.

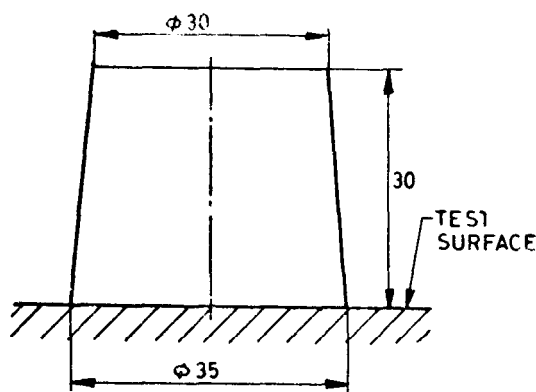
The number of observations and sample conditions shall also be a subject of mutual agreement between the purchaser and the manufacturer.

A-6 NUMBER OF HARDNESS TESTS PER BATCH

A-6.1 Number of hardness tests per batch (see 10.1 and 13.2.1) shall be as agreed to between the manufacturer and the purchaser.

A-7 RETESTS

A-7.1 Retests shall be carried out as per the stipulations made under 15.



All dimensions in millimetres.

FIG. 7 CAST-ON TEST SAMPLE FOR BRINELL HARDNESS TEST

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